REMEDIATION DESIGN AND DEVELOPMENT REPORT

Prepared for

PLANT FACILITIES ENGINEERING, INC.
ST. LOUIS MISSOURI

☀ DAMES & MOORE

Dames & Moore Job No. 06702-113-209
September 19, 1994

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1.0 INTRODUCTION

Dames & Moore was retained by Plant Facilities and Engineering (PF&E) on July 27, 1994 to provide testing and design services to remediate the Building 3 Basement at the St. Louis Army Ammunition Plant in St. Louis, Missouri. Dames & Moore's July 15, 1994 proposal to provide testing and design services provided a phased approach as defined in the PF&E request for proposal (RFP). The following phases were authorized by PF&E:

Phase   I - Building 3 Basement Characterization

Phase II - Remediation Design and Development

Phase III - Remediation Design Plans and Specifications Preparation

Phase I was completed September 30, 1994 with the submittal of the Building 3 Basement Characterization Report. Dames & Moore provided a presentation of the results of the characterization effort. During the presentation, three remedial alternatives were discussed to remediate the Building 3 Basement. The three remedial alternatives discussed include:

- Risk-based site specific cleanup concentrations;
- Surface remediation to current cleanup standards provided in the Notice of Noncompliance (NON); and
- Demolition of the building.

This report describes the existing conditions, discusses the three remedial alternatives provided above, provides the risks associated with each alternative, and a cost estimate and schedule for each remedial alternative.

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2.0 EXISTING CONDITIONS

The characterization of the Building 3 Basement was limited to surface wipe or soil sample analysis for polychlorinated biphenyls (PCBs), pesticides, and ammonia. Ammonia was analyzed as an indicator of urea. The laboratory results of sampling for the Building 3 Basement characterization follow. The following tables are provided in Appendix A. Sample descriptions, locations and summarized laboratory results are provided in Table 1. Soil sample results and concentration analyses are provided in Tables 2 and 3, respectively. Floor wipe sample results and concentration analyses are provided in Tables 4 and 5, respectively. Horizontal beam wipe sample results and concentration analyses are provided in Tables 6 and 7, respectively. Vertical (walls and columns) wipe sample results and concentration analyses are provided in Tables 8 and 9, respectively. Ceiling wipe sample results and concentration analyses are provided in Tables 10 and 11, respectively. Laboratory reports and Figure 1 which provided the sample locations were provided in the Building 3 Basement Characterization Report and are not included in this report.

2.1   Soil Sample Results

A total of nine soil samples were collected from the Building 3 Basement. Random samples were collected from unstained areas. Three random samples, five biased samples. and one quality assurance/quality control (QA/QC) sample were collected. One random soil sample (or random wipe sample) was collected for every approximate 20,000 square feet of floor. Soil samples were collected at sample locations where concrete floor did not exist and wipe samples were collected on concrete floor surfaces. Biased soil samples were collected within stained areas.

PCBs

The results for all soil samples reported PCB concentrations below detection limits. The detection limit for PCBs was 0.5 mg/kg.

Pesticides

Pesticides were detected in two of the three random samples. The pesticides detected included 4,4'-DDT and 4,4'-DDD. The maximum pesticide concentration reported for the random samples was 0.1985 mg/kg of 4,4'-DDT at sample location 15.

Pesticides were detected in three of the five biased samples collected. The pesticides detected include 4,4'-DDD, 4,4'-DDT, Gamma BHC (Lindane) and Endrin. The maximum pesticide concentration reported for the biased samples was 6.611 mg/kg of 4,4'-DDD at sample location 63.

Ammonia

Ammonia was detected in all soil samples. The median and average ammonia concentrations were 19 mg/kg and 28.6 mg/kg, respectively. The maximum reported ammonia concentration was 87.5 mg/kg at sample location 62.

2.2   Floor Wipe Sample Results

A total of 17 wipe samples were collected from the floor of the Building 3 Basement. Random and biased samples were collected. Random samples were collected from unstained areas. One random soil sample or random wipe sample was collected for every approximate

20,000 square feet of floor. Biased samples were collected within stained areas. Eight random samples, seven biased samples and two QA/QC samples were collected.

PCBs

Aroclor 1260 was detected in two of the eight random wipe samples collected from the floor. The maximum PCB concentration reported for the random wipe samples was 20.5 μg/100 cm^2 at sample location 19.

Aroclor 1260 was detected in five of the seven biased wipe samples from the floor. The maximum PCB concentration reported for the biased samples was 753.2 μg/100 cm^2 at sample location 44A. Sample location 44A was a duplicate sample from sample location 44. The PCB concentration reported for sample location 44 was 88.8 μg/100 cm^2.

Pesticides

Pesticides were detected in all random wipe samples from the floor. The pesticides detected include 4,4'-DDD, 4,4'-DDT and Gamma BHC (Lindane). The maximum pesticide concentration reported for the random wipe samples was 130.5 μg/100 cm^2 of 4,4'-DDT at sample location 14.

Pesticides were detected in all biased wipe samples collected from the floor. The pesticides detected include 4,4'-DDD, 4,4'-DDT, Gamma BHC (Lindane), Heptachlor Epoxide, Dieldrin, and Endrin. The maximum pesticide concentration reported for the biased wipe samples was 1102.2 μg/100 cm^2 of 4,4'-DDD from sample location 44A. Sample location 44A was a duplicate sample from sample location 44. The 4,4-DDD concentration for sample location 44 was 55.0 μg/100 cm^2.

Ammonia

Ammonia was detected in 15 of the 17 random and biased wipe samples collected from the floor. The median and average wipe sample concentrations were 89.0 and 121.15 μg/100 cm^2. The maximum reported wipe sample ammonia concentration was 342 μg/100 cm^2 at sample location 44A. Sample location 44A was a duplicate sample from sample location 44. The ammonia concentration for sample location 44 was 314 μg/100 cm^2.

2.3   Horizontal Beam Wipe Sample Results

A total of 17 horizontal beam wipe samples were collected from the top surface of the bottom flange of the horizontal steel beams from the Building 3 Basement. Random and biased wipe samples were collected. Random samples were collected from unstained areas. One random wipe sample from the horizontal beams was collected for every approximate 20,000 square feet of floor. Biased samples were collected within stained areas. Eleven random samples, four biased samples and two QA/QC samples were collected.

PCBs

Aroclor 1260 was detected in three of the eleven random wipe samples collected from the horizontal beams. The maximum PCB concentration reported for the random wipe samples was 209.93 μg/100 cm^2 at sample location 6.

Aroclor 1260 was detected in two of the four biased wipe samples from the horizontal beams. The maximum PCB concentration reported for the biased wipe samples was 58.2 μg/100 cm^2 at sample location 45.

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Pesticides

Pesticides were detected in all random wipe samples collected from the horizontal beams. The pesticides detected include 4,4'-DDD, 4,4'-DDT, Gamma BHC (Lindane), and Methoxychlor. The maximum pesticide concentration reported for random wipe samples from horizontal beams was 44.58 μg/100 cm^2 of 4,4'-DDT from sample location 5.

Pesticides were detected in all biased wipe samples from the horizontal beams. The pesticides detected include 4,4'-DDD, 4,4'-DDT, Gamma-BHC (Lindane) and Heptachlor Epoxide. The maximum pesticide concentration reported for the biased wipe samples from horizontal beams was 91.3 μg/100 cm^2 of 4,4'-DDD from sample location 40A. Sample location 40A was a duplicate sample from sample location 40. The 4,4'-DDD concentration reported for sample location 40 was 13.6 μg/100 cm^2.

Ammonia

Ammonia was detected in 15 of the 17 wipe samples collected from the horizontal beams. The median and average wipe sample concentrations were 71.6 and 85.71 μg/100 cm^2, respectively. The maximum reported wipe sample ammonia concentration was 294 μg/100 cm^2 at sample location 8.

2.4   Vertical Wipe Sample Results

A total of 21 vertical wipe samples were collected from vertical surfaces in the Building 3 Basement. Vertical surfaces include walls and columns. Random and biased wipe samples were collected. Random samples were collected from unstained areas. One random wipe sample from vertical surfaces was collected for every approximate 5,000 square feet of wall

area. Biased samples were collected within stained areas. Five random wipe samples, 15 biased wipe samples and one QA/QC wipe sample were collected.

PCBs

The results for all vertical random wipe samples indicated PCB concentrations below detection limits. The detection limit for PCB wipe samples was 0.5 $\mu g/100cm^2$.

Aroclor 1260 was detected in five of the 15 biased wipe samples collected from vertical surfaces. The maximum PCB concentration was 82.4 $\mu g/100$ cm^2 from sample location 47.

Pesticides

Pesticides were detected in four of the five random wipe samples collected from vertical surfaces. The pesticides detected include 4,4'-DDD, 4,4'-DDT and Gamma BHC (Lindane). The maximum pesticide concentration reported for random wipe samples from vertical surfaces was 11.722 $\mu g/100$ cm^2 of 4,4'-DDT from sample location 27.

Pesticides were detected in all biased wipe samples collected from vertical surfaces. The pesticides detected include 4,4'-DDD, 4,4'-DDT, Gamma BHC (Lindane), Endrin Aldehyde, Heptachlor Epoxide, and Beta BHC. The maximum pesticide concentration reported for biased wipe samples from vertical surfaces was 202.3 $\mu g/100$ cm^2 of 4,4'-DDD from sample location 59.

Ammonia

Ammonia was detected in 13 of the 21 vertical wipe samples collected. The median and average sample concentrations were 31.5 and 35.96 μg/100 cm^2, respectively. The maximum reported wipe sample ammonia concentration was 86.1 μg/100 cm^2 from sample location 27.

2.5   Ceiling Wipe Sample Results

A total of ten ceiling wipe samples were collected from the ceiling in the Building 3 Basement. Random and biased wipe samples were collected. Random samples were collected from unstained areas. One random wipe sample from the ceiling was collected for every approximate 40,000 square feet of ceiling. Biased samples were collected from stained areas. Six random wipe samples, three biased wipe samples and one QA/QC wipe sample were collected.

PCBs

The results for all random wipe samples from the ceiling reported PCB concentrations below detection limits. The detection limit for PCB wipe samples was 0.5 μg/100 cm^2.

Aroclor 1260 was detected in one of the three biased wipe samples collected from the ceiling with a reported concentration of 17.6 μg/100 cm^2 from sample location 53.

Pesticides

Pesticides were detected in six of the seven random wipe samples collected from the ceiling. The pesticides detected include 4,4'-DDD and 4,4'-DDT. The maximum pesticide

concentration reported for random wipe samples from the ceiling was 2.936 μg/100 cm^2 of 4,4'-DDT from sample location 31.

Pesticides were detected in all biased wipe samples collected from the ceiling. The pesticides detected include 4,4'-DDD, 4,4'-DDT, Gamma BHC (Lindane) and Heptachlor Epoxide. The maximum pesticide concentration reported for biased wipe samples from the ceiling was 23.2 μg/100 cm^2 of 4,4'-DDD from sample location 53.

Ammonia

Ammonia was detected in two of the ten ceiling wipe samples collected. The maximum reported wipe sample ammonia concentration was 37.4 μg/100 cm^2 from sample location 31.

2.6   QA/QC Sample Results

A total of fifteen QA/QC samples were collected during the Building 3 Basement Characterization sampling effort. The QA/QC samples include eight duplicate samples and seven field blanks.

Duplicate samples were collected from side-by-side locations. Comparison of the duplicate samples with original samples indicated significant variations for the components analyzed. The variation in concentrations was attributed to the physical difference of sample locations.

Evaluation of field blank samples indicated detectable levels of pesticide and ammonia. The pesticide concentrations were low concentrations in the field blank and were not significant enough to discredit the data. The ammonia concentrations in the field blanks were attributed to

possible background ammonia concentrations in air, and likewise were not significant enough to discredit the data.

2.7   Fluorescent Light Ballast

Fourteen fluorescent light ballasts were found in the basement.

3.0 REMEDIAL ALTERNATIVES

Three remedial alternatives have been reviewed for this project and include:

- Alternate 1 - Development of risk-based site specific cleanup criteria and remediation.

- Alternate 2 - Surface remediation to modified cleanup criteria proposed by Region 7 U.S. Environmental Protection Agency (USEPA).

- Alternate 3 - Remediation to the proposed cleanup criteria provided by Region 7 USEPA.

A discussion of each remedial alternative follows. The discussion for Alternative 1 provides background information and describes methods used for Risk Assessments. Clean up criteria, remediation method and risks associated with each alternative are provided in the discussions for Alternatives 2 and 3.

3.1   Alternative 1

3.1.1   Risk-Based Evaluation of PCB and Pesticide Monitoring Data

RISK ASSESSMENT BACKGROUND

A Risk Assessment (RA) is an analysis that evaluates the following information: (1) residual chemical concentrations, (2) rates of human exposure to the chemicals, and (3) the toxicity of the chemicals; in order to determine the risks to human health due to the chemical exposure. If the calculated risks are low, then the requirement for site remediation is minimized or eliminated. High calculated risks usually represent greater remedial requirements.

Site chemical concentrations are determined by sampling and analysis. Rates of human exposure are calculated by evaluating contact rates with contaminated media (i.e., rate at which contaminated air is breathed, rate at which contaminated surfaces are touched, etc.). Toxicity of chemicals is well-documented in published literature.

RISK ASSESSMENT TECHNICAL APPROACH

The goal of the RA for the basement of Building 3 is to evaluate actual or realistic potential human health risks posed by contaminated areas represented by soil and building surfaces.   The risk estimates will then be used to help evaluate different potential building management alternatives such as, no action, no action with future monitoring, limited remediation or encapsulation.

To facilitate the assessment, the four basic RA technical components will be implemented: (1) review of monitoring data and selection of contaminants of concern. (2)

exposure assessment, (3) toxicity assessment, (4) risk characterization. The implementation of each of these RA components is discussed below.

TASK 1--Data Review and Selection of Contaminants of Concern. The purpose of data evaluation and identification of contaminants of concern (COCs) is to evaluate the chemicals detected in the various site media (i.e., building surfaces and soil) to identify which contribute to risks or hazards to the public and the environment. Dames & Moore believes that PCBs and all detected pesticides should be evaluated in the RA.

TASK 2--Exposure Assessment. The purpose of the exposure assessment is to identify populations who are or may be exposed to the building contaminants in the future. Preliminary information suggests that individuals performing periodic maintenance or inspection of the basement are the potential exposed population of concern, both currently and in the future. The current owner is presumed to maintain ownership of the building into the foreseeable future, therefore, alternative exposed populations are not anticipated.

The specific subtasks involved with implementing the exposure assessment will include:

- Identify human receptors

- Identify pathways

- Calculate exposure point concentrations based on the monitoring data

- Calculate human intake of the various chemicals based on the exposure point concentrations and the pathway.

Identification of Human Receptors--As stated, maintenance personnel are the presumed human receptors.

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Identification of Exposure Pathways--This will include the simultaneous evaluation of contaminant sources (i.e., soil and building surfaces), chemical release mechanisms, receiving media, and fate and transport characteristics of the subject PCB and pesticides. The exposure pathway analysis is intended to identify media (e.g., air) that are receiving or may receive site-related chemicals and possibly facilitate human exposures. Examples of anticipated pathways include: dermal contact with soil and building surfaces, incidental ingestion of contaminated dust that may become airborne, and inhalation of either contaminated dust or chemical vapors that may be present in air. The relatively damp conditions typical of basement environments is anticipated to minimize dust or vapor levels.

Calculation of Exposure Point Concentrations--Exposure point concentrations are the concentrations of PCBs or pesticides to which the potential population may be exposed. They are estimated using statistical analysis of the analytical results of representative samples of the exposure media (i.e., building surfaces or soil) for the subject exposure pathway (i.e. dermal, inhalation or ingestion).

TASK 3--Toxicity Assessment. The purpose of the toxicity assessment is to weigh available evidence regarding the potential for particular contaminants to cause adverse effects in exposed individuals and to provide, where possible, an estimate of the relationship between the extent of exposure to a contaminant and the increased likelihood and/or severity of adverse effects. The toxicity assessment will consist of:

- Identifying exposure periods for which toxicity values are necessary.
- Determining toxicity values for noncarcinogenic effects and carcinogenic effects.
- Summarizing the toxicity information.

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Identify Exposure Periods--The length of the exposure period will determine which of the multiple non-carcinogenic indices of toxicity for noncarcinogenic effects should be utilized--either the chronic reference dose for exposure durations longer than 7 years or the subchronic reference dose for exposure durations less than 7 years.

Determine Toxicity Values for Noncarcinogenic and Carcinogenic Effects--A reference dose (RfD) will be the quantitative index used in evaluating noncarcinogenic effects. The RfD represents the maximum allowable intake of noncarcinogens that is protective of human health, and is expressed in terms of mass of contaminant per kilogram of body weight per day (mg/kg/day). For potential carcinogens, slope factors (SFs) will be the quantitative measures of a carcinogen's potency or ability to induce tumors in an exposed individual. The carcinogenic SF is expressed as the lifetime cancer risk per milligram of contaminant per kilogram of body weight per day ($(mg/kg/day)^{-1}$).

TASK 4--Risk Characterization. The purpose of risk characterization is two-fold. First, it will involve relating exposure estimates to toxicity data to facilitate quantification of potential health risks. Second, it will involve identification of uncertainties related to the RA.

Quantification of Risks and Hazards--Quantification of human health and hazards will be conducted for individual contaminants. For carcinogens, the unit cancer risk estimates (SFs) are used with the estimated exposure concentrations to calculate site-specific risk estimates. To characterize potential noncarcinogenic effects (hazards), the estimated intake levels for each COC are compared to the quantitative indices of toxicity (e.g., RfDs) to calculate a noncarcinogenic hazard quotient.

Carcinogenic risks are calculated for cumulative lifetime effects to be expected in a large population of receptors. In accordance with the National Contingency Plan,

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REPORTING

The RA findings will be presented as a Preliminary Draft for review. Upon authorization, the report will be revised as necessary and submitted to EPA Region 7. Comments offered by EPA Region 7 will be reviewed and responded to as appropriate.

Dames & Moore believes the RA should be extended to encompass the entire building. The RA for only a small portion of the building may appear inappropriate by EPA. The cost and schedule to complete the RA for the entire building is provided in Table 1 and Figure 1, respectively.

3.1.2 Risk Assessment Alternative Risks

Alternative 1 poses significant risk for EPA acceptance. EPA may use its discretion to accept RA data or totally disregard the data. EPA may agree with the exposure assessment or may conclude the exposure assessment should assume constant contact with an impacted surface for a lifetime. The later assumption would impact the risk-based cleanup concentrations for residual chemicals by several orders of magnitude.

The costs for implementing a risk assessment compared with the remaining remedial alternatives are significantly lower. The benefits of a risk assessment include the following:

- Dames & Moore anticipates the risk assessment will conclude limited remediation or no further action will be required to remediate the basement or remaining portion of the building for PCBs or pesticides;

- actual data will be compiled to forecast current and future exposures; and

- data will be compiled for possible EPA negotiations.

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Surface wiping will consist of wiping surfaces with absorbent cloths saturated with a solvent or surfactant and water. The absorbent cloth will then be disposed after cleaning.

Confirmation sampling will consist of collecting wipe samples within 2500 square foot grids. The wipe samples will be collected from stains within the grid areas. The stained locations exhibiting the greatest concentrations during the characterization of the basement in descending order were the floor, horizontal beams and vertical surfaces. Therefore, the hierarchy of confirmation sample collection locations will consist of floor stains, horizontal beam stains and vertical stains. If the before mentioned stains are not present within the sampling grid, the sample will be collected from a location at the discretion of the sampler.

Grid areas will be recleaned once using the before mentioned cleaning methods. Confirmation sampling will be conducted after the recleaning. If the grid area does not meet the cleanup standards, the entire grid area, excluding soil, will be encapsulated.

Encapsulation will consist of covering the surfaces within the grid area with a double layer encapsulant to preclude future exposures. The encapsulant will have sufficient bonding and sealing characteristics to limit future exposures. A surface coat encapsulant, of different color, will be placed over the base coat encapsulant. A maintenance and inspection program will then be implemented to maintain the integrity of the surface coat. When the surface coat has worn sufficiently to expose the underlying base coat, the surface coat will then be replaced.

Waste disposal will commence as the waste is generated. The following wastestreams have been identified which require disposal:

- Solids generated while vacuuming;

- Wastes generated from surface wiping (*i.e.*, absorbents);

- Treated water from pressure washing;

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Demolition and removal will be the method of achieving the cleanup criteria. This alternative considers the entire building for remediation because demolition of foundation structures in the basement will require demolition of the upper floors.

3.3.2 Remediation Method

Remediation will consist of demolition and removal of the building, disposal characterization, backfilling and paving. Demolition debris from the upper floors will be separated from demolition debris from the basement. Core sample results from the upper floors will be used to characterize the waste for disposal. Core samples will be collected from the basement for disposal characterization. The cost estimate provided in Table 3 provides a range of costs due to disposal costs for Toxic Substances Control Act (TSCA) waste with PCB concentration greater than or equal to 50 ppm and special waste with PCB concentrations less than 50 ppm. The volumes of demolition debris meeting the above disposal criteria can not be estimated without destructive core testing in the basement and review of existing data from the upper floors.

After the building has been demolished and debris removed, confirmation samples of the underlying soils will be collected. If the PCB concentration is less than 10 ppm, the excavation will be backfilled. If the PCB concentration is greater than 10 ppm, the impacted soil will be excavated and disposed. Excavation will continue until the soil cleanup criteria is reached or the excavation extends three feet below the original elevation of the basement or extends laterally 15 feet beyond the exterior walls of the basement. Excavation of impacted soil is not anticipated to be required and is not included in the cost estimate provided in Table 3.

The excavation will be backfilled and paved to meet the existing grade. The new pavement will be graded to drain toward existing stormwater drainage.

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Presumptive remedies are part of EPA's Superfund Accelerated Cleanup Model. Presumptive remedies recommend the same remedial efforts for similarly contaminated sites. If a (ROD) for a similar site with PCB contamination has been approved by EPA and the ROD provides higher cleanup standards than currently provided by the NON, a presumptive remedy could be proposed to EPA.

If an applicable ROD does not exist or EPA Region 7 rejects the presumptive remedy concept, negotiations with EPA for higher cleanup standards or encapsulation should commence. Once obtainable cleanup standards or encapsulation is approved by EPA, Alternative 2 or a notification of Alternative 2 could commence.

Alternative 3 should only be considered as a negotiation tool and should only be considered as a last option.

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Table 1
Preliminary Costs
St. Louis Army
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Alternate 1
Risk Assessment for Building 3 Basement Only

Task	Description	Costs
Sample Collection	16 air samples	$12,540
Risk Assessment Report		$24,750
EPA Negotiations and Meetings		$19,800
Total		$57,090

Alternate 1
Risk Assessment for Building 3

Task	Description	Costs
Sample Collection	43 air samples	$31,100
Risk Assessment Report		$45,000
EPA Negotiations and Meetings		$19,800
Total		$95,900

Assumptions:

1. Air samples will be collected at a rate of 12 samples per floor with 3 background samples and one blank per 10 samples analyzed.

2. Cost estimate assumes two meetings with EPA including preparation time for meetings.

3. The cost estimate for the entire building assumes sufficient data is available and will be provided for review.

Table 3
Preliminary Costs
St. Louis Army
Ammunition Plant Building 3 Basement

Alternate 3
Demolition

Task	Description	Costs
Asbestos Abatement	Estimate	$250,000
Demolition	$10/sq. ft./floor	$4,250,000
Disposal (Special)	33,200 tons @ $50/ton	$1,992,000
Disposal (Hazardous)	33,200 tons @ $350/ton	$11,620,000
Engineering	Permitting, Characterization, Oversight	$400,000
Total (Special)		$6,892,000
Total (Hazardous)		$16,520,000

Assumptions:

1. Asbestos abatement is estimated because actual quantities of asbestos are unknown at this time.

2. Estimates based upon 170,000 square feet of floor.

3. Assumed 442,350 cubic feet of concrete at 150 pounds per cubic foot.

TABLE 1
SAMPLE RESULTS
BASEMENT OF BUILDING 3
ST. LOUIS ARMY AMMUNITION PLANT

Sample Location	Location Description	Sample I.D. No.	Results			Description
			Ammonia (ug/100cm^2)	PCB (ug/100cm^2)	Total Pest. (ug/100cm^2)	
13	Floor, Soil Random	SLAP–13	9.83 mg/kg	ND mg/kg	0.05 mg/kg	Floor. Soil. 10' south of col. C–37
14	Floor, Wipe Random	SLAP–14	178	ND	157.15	Floor. Wipe. 3' south of col. H–34
14A	Floor, Wipe Duplicate	SLAP–14A	185	ND	135.61	Floor. Wipe. 3' south of col. H–34
15	Floor, Soil Random	SLAP–15	59 mg/kg	ND mg/kg	0.31 mg/kg	Floor. Soil. 10' south of col. B–31
16	Floor, Wipe Random	SLAP–16	46.5	ND	82.59	Floor. Wipe. 3' north of col. K–27
17	Floor, Wipe Random	SLAP–17	38	ND	23.91	Floor. Wipe. 3' south of col. E–25
18	Floor, Wipe Random	SLAP–18	90.5	ND	161.9	Floor. Wipe. 3' north of col. K–22
19	Floor, Wipe Random	SLAP–19	89	20	32.22	Floor. Wipe. 3' south of col. D–18
20	Floor, Wipe Random	SLAP–20	34.5	5.3	24.21	Floor. Wipe. 3' south of col. B–14
21	Floor, Wipe Random	SLAP–21	36.2	ND	20.8	Floor. Wipe. 3' south of col. F–11
22	Floor, Soil Random	SLAP–22	7.06 mg/kg	ND mg/kg	ND mg/kg	Floor. Soil. 10' south of col. H–3
23	Vertical, Wipe Random	SLAP–23	30	ND	14.52	Wall. Wipe. Midway between A–3 and A–4
24	Vertical, Wipe Random	SLAP–24	<31	ND	ND	Wall. Wipe. Midway between K–1 and J–1

TABLE 1
SAMPLE RESULTS
BASEMENT OF BUILDING 3
ST. LOUIS ARMY AMMUNITION PLANT

Sample Location	Location Description	Sample I.D. No.	Results			Description
			Ammonia (ug/100cm^2)	PCB (ug/100cm^2)	Total Pest. (ug/100cm^2)	
36	Vertical, Wipe Chip Chute	SLAP–36	30.2	ND	45.14	Column. Wipe. Small column east of col B–18
37	Ceiling, Wipe Biased	SLAP–37	37.2	ND	1.7	Ceiling. Wipe. 1' east of col. D–12
38	Vertical, Wipe Biased	SLAP–38	55.8	ND	5.94	Column. Wipe. South side of col. E–11
39	Vertical, Wipe Biased	SLAP–39	79.5	4.73	26.5	Wall. Wipe. 15' south of col. A–12
40	Horizontal, Wipe Biased	SLAP–40	71.6	10.6	22.81	Top surface of the bottom flange 5' east of col. H–11
40A	Horizontal, Wipe Duplicate	SLAP–40A	<32	ND	143.7	Top surface of the bottom flange 5' east of col. H–11
41	Floor, Wipe Biased	SLAP–41	145	19.4	16.85	Floor. Wipe. 1' north of col. K–14
42	Vertical, Wipe Biased	SLAP–42	30.8	19.4	18.82	Column. Wipe. East side of col. F–4
43	Vertical, Wipe Biased	SLAP–43	<28.5	ND	1.63	Column. Wipe. Southwest corner of col. B–4
44	Floor, Wipe Biased	SLAP–44	314	88.8	164.07	Floor. Wipe. 1' west of col. K–8
44A	Floor, Wipe Duplicate	SLAP–44A	342	753.2	1640.07	Floor. Wipe. 1' west of col. K–8
45	Horizontal, Wipe Biased	SLAP–45	111	58.2	77.22	Top surface of the bottom flange 4' east of col. H–14
46	Floor, Wipe Biased	SLAP–46	178	45.4	62.11	Floor. Wipe. 1' southeast of col. C–16

TABLE 1
SAMPLE RESULTS
BASEMENT OF BUILDING 3
ST. LOUIS ARMY AMMUNITION PLANT

Sample Location	Location Description	Sample I.D. No.	Results			Description
			Ammonia (ug/100cm²)	PCB (ug/100cm²)	Total Pest. (ug/100cm²)	
59	Vertical, Wipe Biased	SLAP-59	<31.5	ND	289.36	Column. Wipe. South side of col. J-35
60	Floor, Wipe Biased	SLAP-60	76.8	ND	21.8	Floor. Wipe. 1' south of col. F-37
61	Vertical, Wipe Biased	SLAP-61	47.7	ND	0.82	Wall. Wipe. 10' south of col. F-43
62	Floor, Soil Biased	SLAP-62	87.5 mg/kg	ND mg/kg	ND mg/kg	Floor. Soil. 8' east of col. G-34
63	Floor, Soil Biased	SLAP-63	22.3 mg/kg	ND mg/kg	6.61 mg/kg	Floor. Soil. 10' east of col. E-35 (ditch)
64	Floor, Soil Biased	SLAP-64	19 mg/kg	ND mg/kg	ND mg/kg	Floor. Soil. 10' east of col. G-41
64A	Floor, Soil Duplicate	SLAP-64A	5.61 mg/kg	ND mg/kg	0.37 mg/kg	Floor. Soil. 10' east of col. G-41
65	Floor, Soil Biased	SLAP-65	39.8 mg/kg	ND mg/kg	1.94 mg/kg	Floor. Soil. 10' west of col. B-17
66	Floor, Soil Biased	SLAP-66	7.29 mg/kg	ND mg/kg	3.81 mg/kg	Floor. Soil. 10' south of col. F-8
		FB-1	<27.0	ND	ND	Field Blank
		FB-2	<27.5	ND	ND	Field Blank
		FB-3	<23.0	ND	ND	Field Blank
		FB-4	31.6	ND	ND	Field Blank

TABLE 2
SOIL SAMPLE RESULTS
BUILDING 3 BASEMENT
ST. LOUIS ARMY AMMUNITION PLANT

Sample Location	Sample ID No.	Sample Type	4,4' - DDD (mg/kg)	4,4' - DDT (mg/kg)	Gamma BHC (Lindane) (mg/kg)	Endrin (mg/kg)	Aroclor 1260 (mg/kg)	Ammonia (mg/kg)
13	SLAP-13	Random	ND	0.0467	ND	ND	ND	9.83
15	SLAP-15	Random	0.1108	0.1985	ND	ND	ND	59
22	SLAP-22	Random	ND	ND	ND	ND	ND	7.06
62	SLAP-62	Biased	ND	ND	ND	ND	ND	87.5
63	SLAP-63	Biased	6.611	ND	ND	ND	ND	22.3
64	SLAP-64	Biased	ND	ND	ND	ND	ND	19
64A	SLAP-64A	QA/QC	0.299	0.072	ND	ND	ND	5.61
65	SLAP-65	Biased	0.916	0.648	0.376	ND	ND	39.8
66	SLAP-66	Biased	1.537	0.602	0.486	1.188	ND	7.29

Notes: ND - Concentration below detection limits
QA/QC - Quality Assurance/Quality Control (Duplicate Sample)

TABLE 4
FLOOR WIPE SAMPLE RESULTS
BUILDING 3 BASEMENT
ST. LOUIS ARMY AMMUNITION PLANT

Sample Location	Sample ID No.	Sample Type	4,4'-DDD (μ/100cm^2)	4,4'-DDT (μ/100cm^2)	Gamma BHC (Lindane) (μ/100cm^2)	Heptachlor Epoxide (μ/100cm^2)	Dieldrin (μ/100cm^2)	Endrin (μ/100cm^2)	Aroclor 1260 (μ/100cm^2)	Ammonia (μ/100cm^2)
12	SLAP-12	Random	7.29	1.54	0.740	ND	ND	ND	ND	<30
14	SLAP-14	Random	26.4	130.5	0.250	ND	ND	ND	ND	178
14A	SLAP-14A	QA/AC	25.3	110.0	0.310	ND	ND	ND	ND	46.5
16	SLAP-16	Random	26.9	54.5	1.19	ND	ND	ND	ND	46.5
17	SLAP-17	Random	10.6	13.0	0.310	ND	ND	ND	ND	38.0
18	SLAP-18	Random	68.19	90.94	2.768	ND	ND	ND	ND	90.5
19	SLAP-19	Random	13.1	18.1	1.02	ND	ND	ND	20.5	89.0
20	SLAP-20	Random	14.6	9.19	0.420	ND	ND	ND	5.3	34.5
21	SLAP-21	Random	14.0	6.80	ND	ND	ND	ND	ND	36.2
41	SLAP-41	Biased	11.3	1.97	4.88	0.670	ND	ND	19.4	145
44	SLAP-44	Biased	55.0	19.2	1.67	39.3	21.1	27.8	88.8	314
44A	SLAP-44A	QA/QC	1102.2	182.1	13.8	342.3	ND	ND	753.2	342
46	SLAP-46	Biased	29.6	16.3	15.1	1.11	ND	ND	45.4	178
49	SLAP-49	Biased	50.8	79.2	4.21	14.5	ND	ND	126.8	128
52	SLAP-56	Biased	31.7	26.8	1.80	ND	ND	ND	ND	148
56	SLAP-56	Biased	23.2	ND	ND	ND	ND	ND	17.6	<30
60	SLAP-60	Biased	16.6	3.70	1.50	ND	ND	ND	ND	76.8

Notes: ND - Concentration below detection units
QA/QC - Quality Assurance/Quality Control (Duplicate Sample)

TABLE 6
HORIZONTAL BEAM WIPE SAMPLE RESULTS
BUILDING 3 BASEMENT
ST. LOUIS ARMY AMMUNITION PLANT

Sample Location	Sample ID No.	Sample Type	4,4'-DDD (mg/kg)	4,4'-DDT (mg/kg)	Gamma-BHC (Lindane) (mg/kg)	Methoxychlor (mg/kg)	Heptachlor Epoxide (mg/kg)	Aroclor 1260 (mg/kg)	Ammonia (μg)
1	SLAP-1	Random	3.9192	4.8178	ND	ND	ND	ND	56.3
2	SLAP-2	Random	7.256	8.015	ND	ND	ND	ND	<30
3	SLAP-3	Random	1.898	3.027	ND	ND	ND	ND	77.3
4	SLAP-4	Random	5.113	7.965	ND	ND	ND	ND	108
5	SLAP-5	Random	37.049	44.58	0.5902	0.6726	ND	ND	43.8
6	SLAP-6	Random	44.022	41.28	3.316	ND	ND	209.93	51.9
6A	SLAP-6A	QA/QC	17.9	30.6	0.720	ND	ND	ND	62.5
7.	SLAP-7	Random	14.966	29.813	0.4739	ND	ND	92.230	62.9
8	SLAP-8	Random	12.681	21.842	0.3755	ND	ND	37.89	294
9	SLAP-9	Random	4.521	4.372	0.3472	ND	ND	ND	80.4
10	SLAP-10	Random	4.523	5.282	0.3297	ND	ND	ND	188
11	SLAP-11	Random	0.3701	0.4049	ND	ND	ND	ND	85.4
40	SLAP-40	Biased	13.6	1.51	5.49	ND	2.21	10.6	71.6
40A	SLAP-40A	QA/QC	91.3	15.7	36.7	ND	ND	ND	<32
45	SLAP-45	Biased	50.4	19.2	7.62	ND	ND	58.2	111
55	SLAP-55	Biased	11.7	13.8	1.39	ND	ND	ND	76.9
55A	SLAP-55A	Biased	15.9	19.2	1.99	ND	ND	ND	56.1

Notes: ND - Concentration below detection limit
QA/QC - Quality Assurance/Quality Control (Duplicate Sample)

TABLE 8
VERTICAL WIPE SAMPLE RESULTS
BUILDING 3 BASEMENT
ST. LOUIS ARMY AMMUNITION PLANT

Sample Location	Sample ID No.	Sample Type	4,4'-DDD (mg/kg)	4,4'-DDT (mg/kg)	Gamma BHC (Lindane) (mg/kg)	Endrin Aldehyde (mg/kg)	Heptachlor Epoxide (mg/kg)	Beta BHC	Aroclor 1260 (mg/kg)	Ammonia (μg)
23	SLAP-23	Random	8.94	5.22	0.360	ND	ND	ND	ND	30.0
24	SLAP-24	Random	ND	ND	ND	ND	ND	ND	ND	<31
25	SLAP-25	Random	3.988	5.629	0.2536	ND	ND	ND	ND	32.7
25A	SLAP-25A	QA/QC	2.418	3.046	0.2147	ND	ND	ND	ND	34.7
26	SLAP-26	Random	3.405	4.363	ND	ND	ND	ND	ND	34.5
27	SLAP-27	Random	1.373	11.722	ND	ND	ND	ND	ND	86.1
34	SLAP-34	Biased	15.8	6.24	ND	2.87	5.50	ND	ND	60.9
35	SLAP-35	Biased	22.4	7.54	1.05	ND	3.53	ND	ND	38.1
36	SLAP-36	Biased	27.9	10.6	3.64	ND	3.00	ND	ND	30.2
38	SLAP-38	Biased	4.29	0.670	0.980	ND	ND	ND	ND	55.8
39	SLAP-39	Biased	8.25	12.7	5.55	ND	ND	ND	4.73	79.5
42	SLAP-42	Biased	11.3	1.97	4.88	ND	0.670	ND	19.4	30.8
43	SLAP-43	Biased	0.960	0.520	0.150	ND	ND	ND	ND	<28.5
47	SLAP-47	Biased	44.0	21.4	8.01	ND	ND	ND	82.4	<29.0
48	SLAP-48	Biased	13.95	1.0167	0.8269	ND	ND	ND	1.79	<26.5
50	SLAP-50	Biased	3.35	2.75	ND	ND	ND	0.850	ND	<28.0
51	SLAP-51	Biased	13.3	3.86	ND	ND	ND	0.860	ND	29.0
54	SLAP-54	Biased	27.9	7.14	5.86	ND	ND	ND	55.3	<27.5

TABLE 9
VERTICAL WIPE SAMPLE CONCENTRATION ANALYSIS
BUILDING 3 BASEMENT
ST. LOUIS ARMY AMMUNITION PLANT

Parameter	Range of Concentrations of Random Vertical Wipe Samples	Average Concentration of Random Vertical Wipe Sample	Range of Concentrations for Biased Vertical Wipe Samples	Average Concentration of Biased Vertical Wipe Samples	Total Number of Samples Collected	Range of Concentrations of All Vertical Wipe Samples	Average Concentration of All Vertical Wipe Samples	Detection Limit
4,4'-DDD	ND - 8.94	3.36	0.74 - 202	29.37	21	ND - 202	21.56	0.04
4,4'-DDT	ND - 11.722	5.00	0.077 - 82.9	11.84	21	ND - 82.9	9.79	0.010
Gamma BHC	ND - 0.2147	0.14	ND - 8.01	2.47	21	ND - 8.01	1.77	0.010
Beta BHC	ND	ND	ND - 0.86	0.13	15	ND - 0.86	0.10	0.040
Endrin Aldehyde	ND	ND	ND - 2.87	0.53	21	ND - 2.87	0.48	0.7
Heptachlor Epoxide	ND	ND	ND - 5.50	0.91	21	ND - 5.50	0.64	0.010
Aroclor 1260	ND	ND	ND - 82.4	11.85	21	ND - 82.4	8.37	0.500
Ammonia	ND - 86.1	38.92	ND - 79.5	34.70	21	ND - 86.1	35.96	Approximate 30

Notes: ND - Concentration below detection limits
QA/QC - Quality Assurance/Quality Control (duplicate sample)

TABLE 11
CEILING WIPE SAMPLE CONCENTRATION ANALYSIS
BUILDING 3 BASEMENT
ST. LOUIS ARMY AMMUNITION PLAN

Parameter	Range of Concentrations of Random Ceiling Wipe Samples	Average Concentration of Random Ceiling Wipe Samples	Range of Concentrations of Biased Ceiling Wipe Samples	Average Concentration of Biased Ceiling Wipe Samples	Total Number of Samples Collected	Range of Concentrations of All Ceiling Wipe Samples	Average Concentration of All Ceiling Wipe Samples	Detection Limit
4,4'-DDD (mg/kg)	ND-2.456	0.51	0.900-23.2	11.21	10	ND-23.2	3.72	0.040
4,4'-DDT (mg/kg)	ND-2.936	0.67	ND-3.64	1.42	10	ND-3.64	0.90	0.010
Gamma BHC (mg/kg)	ND	ND	ND-0.19	0.12	10	ND-0.19	0.04	0.010
Heptachlor Epoxide (mg/kg)	ND	ND	ND-0.033	0.014	10	ND-0.033	0.008	0.010
Aroclor 1260 (mg/kg)	ND	ND	ND-17.6	6.03	10	ND-17.6	1.99	0.500
Ammonia (μg)	ND-37.4	18.5	ND-37.2	22.4	10	ND-37.4	19.69	Approximate 30

.Note: ND - Concentration below detection limits
QA/QC - Quality Assurance/Quality Control (duplicate sample)